FABRICATION OF Lu_2O_3 CERAMICS BY SINTERING OF SPHERICAL PARTICLES

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Nowadays optical ceramics based on compounds with cubic structure is considered as a novel class of functional materials. High density (ρ=9.42 g/cm^3), high absorption coefficient of X-rays and excellent thermo mechanical properties allow one to consider Lu_2O_3 as a promising host for rare earth luminescent ions for laser or scintillation applications. Nowadays different wet-chemical processes were applied to produce submicron-sized Lu_2O_3:Eu^{3+} crystallites, including a combustion synthesis and molten salts route. Regardless the method used the obtaining of non-agglomerated spherical powders of 100 nm diameter. Such a powders can be easily fabricated by conventional co-precipitation method. This work is devoted to produce Lu_2O_3:Eu^{3+} optical ceramics by vacuum sintering of spherical particles.

Lu_2O_3:Eu^{3+} (0-10 %at.) nanopowders have been obtained by co-precipitation method using urea as a precipitant. The phase evolution of precursor depending on calcination temperature has been studied using DTA, IR spectroscopy and XPA methods. The morphology of synthesized powders has been studied using SEM and TEM. It has been shown that synthesized Lu_2O_3 particles possess spherical morphology and average size of 50-150 nm. The compact having green density of 45-50% were obtained by uniaxial pressing or slip casting. The vacuum sintering of compacts has been performed using vacuum furnace at T=1750-1850°C for 10 hours. It has been shown that vacuum sintering allows one to obtain translucent Lu_2O_3:Eu^{3+} ceramics even the uniaxial pressing is used for consolidation of nanopowders. It confirms that utilization of Lu_2O_3 spherical powders allows one to obtaine of optical ceramics. It has been determined that vacuum sintered Lu_2O_3 ceramics has relative density of 99%, average grain size of 10-20 mkm and a little porosity. The main luminescent properties of Lu_2O_3:Eu^{3+} ceramics have been determined. The scintillation response of Lu_2O_3:Eu^{3+} ceramics for X-rays, α-, γ-radiation has been clearly demonstrated. The ways to improve the optical transmittance of obtained transparent ceramics have been discussed.